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SOUTHWEST FISHERIES CENTER AWARDS AND PUBLICATIONS, 1986

The Southwest Fisheries Center has once again received recognition for the quality of its publications. Dr. George Boehlert of the Honolulu Laboratory received the NMFS Outstanding Publication award for the best publication appearing in a 1985 issue of the U.S. Fishery Bulletin. The award was for his paper entitled "Using objective criteria and multiple regression models for age determination in fishes" (volume 83, number 4, pp. 623-643). Richard Uchida and Darryl Tagami received the NMFS Outstanding Publication award for the best publication appearing in a 1984 issue of Marine Fisheries Review. Uchida and Tagami were recognized for their paper on "Groundfish fisheries and research in the vicinity of seamounts in the North Pacific Ocean" (volume 46, number 2, pp. 1-17).

Center scientists also were awarded Honorable Mentions for their publications. Dr. Albert Myrick, along with Edward W. Shallenberger, Ingrid Kang, and David B. MacKay, received an Honorable Mention for their paper "Calibration of dental layers in seven captive Hawaiian spinner dolphins, Stenella longirostris, based on tetracycline labeling," for publications appearing in an issue of Fishery Bulletin for 1984. For publications in Fishery Bulletin for 1985, those receiving Honorable Mention were David Au and Wayne Perryman for their paper on "Dolphin habitats in the eastern tropical Pacific" (volume 83, number 3, pp. 623-643), and Nancy Lo for "Egg production of the central stock of northern anchovy, Engraulis mordax, 1951-82" (volume 83, number 2, pp. 137-150). For 1984 publications in Marine Fisheries Review, Samuel Herrick received an Honorable Mention for his paper on "U.S. tuna trade summary, 1983" (volume 46, number 2, pp. 1-17).

From left to right: Nancy Lo, Samuel Herrick, Albert Myrick, Wayne Perryman, George Boehlert, and David Au.

1986 has proved to be another productive year for publications, evidence of the diligent efforts by the scientists and staff in conducting the research. Below is a list of publications by Center scientists for 1986.

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COASTAL FISHERIES RESOURCES DIVISION
La Jolla, California

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Preliminary Study of Euphausiid Predation on Larval Anchovy off the Coast of California Begun

Understanding the processes affecting recruitment of young fish to a fish stock is a fundamental objective in fishery research. Predation is believed to be a major factor affecting survival of young fish and controlling their recruitment. To estimate the portion of northern anchovy egg and larval mortality due to predation by invertebrates, Fishery Biologist Gail Theilacker is beginning a comprehensive spatial and temporal study of predatory invertebrates off the coast of California. To identify the predators, she is applying a recently developed immunoassay that detects larval anchovy remains (that cannot be visually identified) in the stomachs of euphausiid crustaceans in the laboratory.

The northern anchovy habitat off California was sampled on a California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruise in November 1986 before peak anchovy spawning, and it will be sampled again in March 1987 during peak spawning to determine the incidence of predation by euphausiids. In November, aboard the Scripps Institution of Oceanography research vessel New Horizon, Theilacker collected euphausiids between 2200 and 0200 when they occur with anchovy eggs and larvae in the upper 50 meters of the sea surface. A net with a large 2 mm mesh was used to collect the animals. This net permits eggs and larvae to pass through, precluding biases caused by euphausiids feeding in the net. Collected euphausiids were frozen individually in tubes at -80°C. The following day, Theilacker assayed a subsample (6-10 euphausiids) for the presence of anchovy yolk in their stomachs. After the cruise, more animals were assayed in the laboratory.

On the November CalCOFI cruise, 58 stations were sampled. As expected, anchovy spawning was minimal. At 11 stations positive for anchovy eggs, the median number per tow was 5; at 6 stations that were positive for yolk-sac larvae, the median number per tow was 2.5. All of the positive stations were near shore.

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Fourteen tows to collect invertebrate predators were taken, one each night. Only one of these tows was taken inshore where anchovy were spawning. Seven euphausiid species were collected with Euphausia eximia dominant, accounting for 30% of the catch, followed by E. pacifica at 25%. Nematoscelis difficilis and Nyctiphanes simplex both at 15%, and E. gibboides, Thysanoessa spinifera and E. recurva at about 5% each. To assess the extent of the invertebrate assemblage that may be predatory on larval fish, Theilacker also collected various copepods, amphipods, ostracods, and decapods.

Because northern anchovy spawning was minimal, it was expected that the incidence of predation would be low. Theilacker assayed 123 euphausiids, and 3 individuals (2%) tested positive for anchovy remains. The 3 positive euphausiids were collected at 3 offshore stations, outside of the anchovy spawning area where other fish eggs and larvae (median n = 10/tow) were present. No euphausiids tested positive for feeding on anchovy at the one inshore station where 4 eggs were found.

Theilacker will conduct a similar field study on the next CalCOFI cruise in March 1987 during peak anchovy spawning. If the euphausiid predation rate is high during peak spawning conditions, then a coordinated study to quantify larval fish mortality due to predation will commence. For the information on incidence of predation to be meaningful, results on total anchovy egg and larval mortality rates and on abundances of adult and juvenile euphausiids are needed. Dr. Nancy Lo, Mathematician, will determine the egg and larval mortality rates, and Dr. Edward Brinton, Research Biologist at Scripps Institution of Oceanography, will determine the distribution and size of the euphausiid population for the November 1986 and March 1987 cruises. (G. Theilacker, FTS 893-7125)

COASTAL EASTERN PACIFIC FISHERIES ENVIRONMENTAL INVESTIGATIONS

Seasonal Variation of California Current System Examined in Recently Completed Manuscript

Ronald Lynn, Oceanographer, and Dr. James Simpson of Scripps Institution of Oceanography, have completed a manuscript which examines comprehensively the seasonal variation of the California Current System using 29 years of the CalCOFI data base. Both variations in the large-scale current patterns and water mass characteristics are analyzed. They find that the amplitude and phasing of seasonal variation in dynamic height and the overall standard deviation of dynamic height define three domains: oceanic, coastal and an intervening transition zone. The transition zone is a broad band centered approximately 200 km offshore and parallel to the coast in which the seasonal range is a relative minimum and the standard deviation is a maximum. Lynn

and Simpson hypothesize that semi-permanent mesoscale eddies dominate this zone. Such eddies would contribute heavily to the standard deviation of dynamic height but not its seasonal variation. The transition zone is coincident with the core of flow of the California Current which is further defined by its low surface salinity or a shallow subsurface minimum in salinity. A strong interaction between the core of the Current and the mesoscale eddy field is suggested. Seasonal variation in the fields of temperature, salinity, sigma-t and oxygen are seen to be related to variations in the California Current, the Inshore Countercurrent and the California Undercurrent through vertical adjustments in the density field and through changes in transport of waters having differing characteristics. At depth in the Undercurrent there is an especially strong tie between variations in strength of flow and the extreme values of water characteristics. This manuscript is being submitted to the Journal of Geophysical Research. (R. Lynn, FTS 893-7084)

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Time Series of Southern California Environmental Data Available

Operations Research Analyst Dr. Michael Prager and Fishery Biologist Dr. Alec MacCall have compiled 18 time series of environmental data into several databases. This information is available in a two-part Administrative Report of the SWFC titled, "An environmental data base describing coastal southern California in the years 1920-1984." The data include rainfall, salinity, sea surface temperature, sea level, and upwelling index observations (from Andrew Bakun, Oceanographer at Pacific Fisheries Environmental Group) for various locations along coastal central and southern California. Many of the original data were supplied by PFEG.

Prager and MacCall processed 16 of the 18 series to facilitate anticipated use of the data sets for analysis and modeling. The data processing comprised detrending, deseasonalization, standardization, and estimation of missing values to produce unbroken time series. In the first part (Administrative Report LJ-86-31) they describe the procedures used in transforming the data, and contains tables of summary statistics. The second part (Administrative Report LJ-86-32) contains tables of the data, and is available in three formats: 1) 109 pages of printed copy, 2) a single 5-1/4" MS-DOS floppy disk containing the same information as SAS data sets, and 3) a similar floppy disk with the data in ASCII format. Besides replacing a large amount of paper with a much less expensive diskette, the diskettes have the advantage of being ready-for-use. (A. MacCall, FTS 893-7116)

Stock Synthesis Model and Application to Northern Anchovy Described

Dr. Richard Methot has completed an Administrative Report describing his stock synthesis model and its application to northern anchovy. The model is a flexible scheme which synthesizes fishery landings, observations of biomass and age composition, and environmental data into an estimate of the most likely status of the population. The report is entitled "Synthetic estimates of historical abundance and mortality for northern anchovy, Engraulis mordax." In addition to providing a comprehensive description of past patterns of abundance, the report contains an estimate of the 1986 spawning biomass which was used for determination of the optimum yield for the 1986-87 fishery. Also, the report contains an evaluation of the frequency with which research surveys need to be conducted in order to maintain accurate stock assessments.

The model's estimates of the time series of recruitment and abundance have been used by Randall Peterman, former NRC Fellow, to investigate environmental and stock effects on recruitment in northern anchovy. Methot's work will be reviewed by the Scientific and Statistical Committee of the Pacific Fishery Management Council, as biomass estimates made with the stock synthesis model will provide the basis for management of the northern anchovy fishery. A streamlined version of this report will be submitted to the American Fisheries Society for publication in a special symposium volume on fishery population dynamics. (R. Methot, FTS 893-7117)

Analysis Continues of Bay Area Sportfish Economic Survey Information

Cynthia Thomson, Industry Economist, is continuing her work on the Bay Area Sportfish Economic Study (BASES), which is being conducted to determine the economic value of sportfishing in the San Francisco Bay and Ocean Area. The survey phase of BASES has been completed, and the contractor (CIC Research, Inc. of San Diego) has provided completed questionnaires from 1,543 saltwater recreational anglers residing in 19 central and northern California counties.

Preliminary examination of the data demonstrates the need to deal with sampling bias arising from (1) non-proportional sampling across counties, and (2) overrepresentation of more avid anglers and of salmon and striped bass anglers among the respondents. Thomson has made the appropriate corrections for sampling bias and has derived some statistics on the angling population. Preliminary results indicate:

1. Approximately 30% of the angling population in the 19 counties sampled owns a boat which can be used for saltwater recreational fishing. On average, these boats are actually used

for saltwater fishing (as opposed to freshwater fishing and other activities) approximately 46% of the time. Most of the boats (76%) fall into the 10-20 foot length category.

2. Boat owners make an average of 9.9 fishing trips per year, and non-boat owners make 4.6 trips per year. Fishing activity peaks in the May-August period and reaches its low in the winter months.

3. As the following table shows, boat owners as a whole perceive themselves as more able anglers than non-boat owners.

Saltwater fishing ability	Boat owners	Non-boat owners
Novice	.12	.28
Novice-Intermediate	.12	.22
Intermediate	.39	.35
Intermediate-Advanced	.21	.10
Advanced	.16	.05
Total	1.00	1.00

4. Median household income is higher for boat owners ($35K-50K) than for non-boat owners ($25K-35K). However, as indicated in the following table, occupational status (except for the percent retired) is roughly the same between the two groups.

Occupational status	Boat owners	Non-boat owners
Employed Full Time	.69	.70
Employed Part Time	.07	.08
Unemployed	.01	.02
Homemaker	.02	.02
Retired	.18	.12
Student	.03	.06
Total	1.00	1.00

5. The average amount spent per year on purchases and repair of saltwater fishing gear and equipment (excluding boats, motors, trails and boat-related equipment) is higher for boat owners ($212) than for non-boat owners ($51).

Thomson is currently examining the seasonal patterns of fishing activity, in terms of the distribution of trips across modes and areas, catch rates, and trip expenditures. The angler and trip information will be summarized in a NOAA Technical Memorandum.

The BASES data will also be used to estimate a variety of economic models, which will serve the twin objectives of testing new valuation methodologies and of providing estimates of economic value that will be useful in benefit-cost studies and management analyses. Thomson will be developing economic demand

models based upon "revealed preference" data--that is, she will infer economic values from actual angler behavior. Industry Economist Dr. Daniel Huppert is collaborating with Dr. T. Cameron, Department of Economics at UCLA, to develop economic values estimates for salmon and striped bass fishing from "contingent valuation" data--that is, expressions of value based on responses to hypothetical questions. (C. Thomson, FTS 893-7115)

Economic Research on Northern California Trawl Sablefish Fishery Studied

Dr. Dale Squires, Industry Economist, is continuing his analysis of the Eureka area sablefish fishery. The study is aimed at providing background economic analysis for trip limits on sablefish catches by the trawl and fixed gear fleets. There is concern that the trawlers may not readily be able to harvest species other than sablefish after the imposition of sablefish limits. Undesired harvests of sablefish could then occur, which might lead to discards and unanticipated pressures on the sablefish resource stock. The study uses 1984 trip data from the Pacific Fisheries Information Network Research Data File to examine the possibilities for substituting between sablefish and other species.

An additional area of investigation is the use of Individual Fisherman Quotas in sablefish. This may become a more important area of study in the future as long-run sablefish management is developed. Of particular interest is the recent historic distribution of sablefish harvests among commercial fishermen. Documentation of these shares will probably be an important first step in administering any form of individual share system. (D. Squires, FTS 893-7113)

California Oceanic Shark and Billfish Gillnet Fishery Investigated

Industry Economist Samuel Herrick has begun an investigation to provide baseline information on the operations of the billfish and oceanic shark drift gillnet fishery off southern California. Data from the Pacific Fisheries Information Network (PacFIN) Research Data Base for 1981 through 1984 indicate that for the entire west coast, about 450 vessels per year used gillnet gear and landed shark, billfish or both during this period. This group of vessels was screened to select those that landed only in California and those that obtained more than 50% of their fishing revenue from gillnets--that is, that had gillnet as the "principal gear" in PACFIN terminology. The average size of this California gillnet fleet was 200 vessels during 1981-1984.

During the 1981 through 1984 period, most of the California gillnet vessels had combined landings of shark and billfish of less than 10 tons; few vessels in any of the years had combined

landings greater than 25 tons (Table 1). Most vessels ranged between 21 and 40 feet in length, with relatively few greater than 60 feet in length (Table 2), and the majority had a southern California port as their principal port, the port accounting for the plurality of a vessel's revenue (Table 3). (S. Herrick, FTS 893-7111)

Table 1. Distribution of California gillnet vessels by annual levels of swordfish and shark landings, 1981-84.

1981	Tons of swordfish <5.0	5.0-10.0	10.1-15.0	>15.0	Row totals
Tons of sharks <5.0	133	2	0	1	134
5.1 - 15.0	31	7	2	0	40
15.1 - 25.0	9	5	1	2	17
25.1 - 35.0	3	1	1	0	5
35.1 - 45.0	3	0	2	0	5
>45.0	1	1	0	1	3
Column totals	178	16	6	4	204

1982	Tons of swordfish <5.0	5.1-10.0	10.1-15.0	>15.0	Row totals
Tons of sharks <5.0	155	6	5	0	161
5.1 - 15.0	33	20	3	1	57
15.1 - 25.0	5	8	3	3	19
25.1 - 35.0	1	1	2	1	5
35.1 - 45.0	0	1	4	0	5
>45.0	0	1	1	2	4
Column totals	191	37	13	7	248

1983	Tons of swordfish <5.0	5.1-10.0	10.1-15.0	>15.0	Row totals
Tons of sharks <5.0	170	6	5	0	184
5.1 - 15.0	18	15	12	8	53
15.1 - 25.0	0	1	1	9	11
25.1 - 35.0	1	0	1	4	6
35.1 - 45.0	1	0	0	0	1
>45.0	0	0	0	0	0
Column totals	190	22	19	21	254

1984	Tons of swordfish <5.0	5.1-10.0	10.1-15.0	>15.0	Row totals
Tons of sharks <5.0	47	11	4	9	71
5.1 - 15.0	8	5	1	6	20
15.1 - 25.0	1	0	1	2	4
25.1 - 35.0	0	0	0	0	0
35.1 - 45.0	0	0	0	0	0
>45.0	0	0	0	0	0
Column totals	56	16	6	17	94

Table 2. Length distribution California vessels with gillnet as primary gear, 1981-84.

Length category	1981	1982	1983	1984
<20 ft.	8	12	5	2
21 - 40 ft	164	192	188	56
41 - 60 ft	28	40	54	34
61 - 80 ft	3	4	6	2
>80 ft	1	0	1	0
Total	204	248	254	94

Table 3. Distribution of California gillnet vessels by principal port, 1981-84.

Principal port	1981	1982	1983	1984
San Diego	41	67	65	28
Terminal Is./ San Pedro/ Los Angeles	72	78	73	28
Oxnard/ Ventura	18	19	27	7
Santa Barbara	18	21	23	16

Morro Bay	9	10	4	7
Moss Landing	7	3	11	0
San Francisco/ Oakland	3	12	20	0
Other	38	38	31	8
Total	206	248	255	

FISHERY-MARINE MAMMAL INTERACTIONS DIVISION
La Jolla, California

MARINE MAMMALS ASSESSMENT INVESTIGATIONS

First Cruises of a Five-Year Program to Monitor Dolphin Abundance Completed

The first cruises of a 5-year program to monitor the abundance of stocks of dolphins in the eastern tropical Pacific have been completed, and the scientific observers aboard the two NOAA Ships, the David Starr Jordan and the McArthur, have returned to San Diego. Operations Research Analyst Rennie Holt was the Chief Scientist for the surveys, and Fishery Biologist Wesley Parks was the logistics coordinator, who is also responsible for writing the cruise reports.

The monitoring program is the result of an amendment to the Marine Mammal Protection Act, which directed NMFS to design and carry out the program. The purpose of the program is to determine if the tuna purse seine fishery in the ETP has adversely affected one or more of the dolphin stocks that are associated with the schools of tuna that are fished.

Twelve scientific observers spent their days searching for schools of dolphins. They recorded how many animals they saw, the species of the animals, and where the animals were sighted. This information is now being edited and entered on the database. From preliminary summaries of the data, the two vessels traveled approximately 43,000 nautical miles (n.mi.). The Jordan traversed approximately 21,800 n.mi. ,and the McArthur traversed approximately 21,300 n. mi. Within the study area, about 15,000, 11,000, 6,000, and 6,000 n.mi. were covered in the inside, middle, west and south areas, respectively. During the surveys, 1142 marine mammal schools consisting of 59,235 animals were detected. Observers aboard the Jordan saw 765 schools consisting of 31,136 animals, and 377 schools consisting of 28,099 animals were detected from the McArthur. A total of 790 dolphin schools consisting of 58,568 animals were detected. It was more difficult to detect marine mammals from the McArthur, which experienced rougher weather, than from the Jordan. However, the McArthur covered the south and west areas, which probably have a lower dolphin density.

In conjunction with the dolphin sighting surveys, scientists also conducted research aimed at better defining the oceanographic "habitat" occupied by cetaceans in the ETP, and how changes in the environment affect the dolphin assessments. For example, there appear to be important changes in dolphin distribution in the ETP during a major El Nino, like the one which occurred in 1982-83.

The dolphin habitat research is being coordinated by Dr. Steve Reilly, Fishery Biologist. The habitat data also contribute to major national and international oceanographic studies: the Eastern Pacific Ocean Climate Study (EPOCS) and the Tropical Ocean Global Atmosphere program (TOGA). Collaborating with SWFC scientists in the environmental research are scientists from NOAA-ERL's Atlantic Oceanographic and Meteorological Lab, (AOML), the Duke University Marine Lab, U.C. Santa Cruz, Scripps Institution of Oceanography and the Smithsonian Tropical Research Institution.

While the ships were underway, data were recorded continuously on surface temperature, salinity and fluorescence (as an index of phytoplankton). Expendable bathythermographs (XBTs) were deployed on average six times per day. At dawn and dusk, the ships stopped for about an hour to conduct oceanographic stations at which vertical conductivity-temperature-depth measurements were made by lowering a CTD instrument to 1000 m. Sample bottles attached to the CTD collected sea water at various depths to verify the instrument data, and to obtain vertical profiles of nutrients and flourescence. This year approximately 345 CTD stations were conducted and 1145 XBTs were deployed.

Other projects conducted during the cruises included sighting surveys of birds, turtles and sea snakes, and acoustic measurements of bottom depth and back-scatter from nekton-sized animals in the water column. Satellite-tracked drifting buoys were also deployed by both ships, as part of an ongoing AOML - EPOCS study of surface currents. (R. Holt, FTS 893-7098)

BIOLOGICAL SYSTEMS INVESTIGATIONS

Southwest Fisheries Center Scientists Participate in Training of South American Students

Three SWFC scientists participated in teaching a course entitled "The Biology and Ecology of Marine Mammals" held in Guayaquil, Ecuador, from December 5 to 21. The course was sponsored by the United Nations Environmental Programme and organized by the Inter-American Tropical Tuna Commission. The 35 students came from Ecuador, Venezuela, Colombia, Panama, Peru, and Chile.

Aleta Hohn, Fishery Biologist, discussed dolphin life history, methods of age determination, and determination of states of sexual maturity using gonads. In addition, she set up a demonstration of dolphin dissections and a laboratory session for methods of measuring and sampling ovaries and testes and sectioning ovaries for corpora counts, and for estimating age

from teeth. William Perrin, Senior Scientist, lectured on fishery interactions, especially the tuna/porpoise fishery, stock structure, and possible responses of dolphin populations to exploitation. Mark Lowry, Fishery Biologist, lectured on pinniped biology and field and laboratory techniques, especially for studying feeding habits and age determination. He participated in the laboratory by demonstrating methods of preparing and reading pinniped teeth for age estimation.

The course included an 8-day cruise to the Galapagos Islands on a vessel belonging to the Escuela de Pesca in Manta. The purpose of the cruise was to teach the students how to identify marine mammals at sea, how to conduct marine mammal surveys, and how to fill out data collection forms for those surveys, as well as continuing the lectures begun in Guayaquil. Two of the 8 days were spent at the Galapagos Islands, where the class visited the Charles Darwin Research Station and two Galapagos sea lion rookeries.

Center scientists participated in the course because many of the Latin American countries represented have active tuna fleets and may have the opportunity, if they are not already doing so, to place biological observers aboard tuna boats to collect data on the stocks of dolphins and to obtain samples for life history analyses. Because some of the fishing in the countries occurs in areas where the U.S. fleet does not often fish, analyses of these data may be useful to compare with dolphin samples collected on U.S. tuna boats. It is important that they learn and use the most current techniques available.

In addition, the Center is currently conducting research on the status of pinniped populations that interact with west coast fisheries. Some of these species are found as far south as the equator. To better understand the effects of U.S. fishing activities on these species, it is necessary to have comparable data on abundance and population trends for populations off South America. Courses such as this facilitate cooperation among international scientists and contribute to our ability to manage species independent of international boundaries. (A. Hohn, FTS 893-7088)

HONOLULU LABORATORY
Honolulu, Hawaii

FISHERY MANAGEMENT RESEARCH PROGRAM

Responsibility Assumed for Monitoring Honolulu Fish Auction

In December, the Honolulu Laboratory assumed responsibility for monitoring activity at the Honolulu fish auction. This responsibility was formerly exercised by the Western Pacific Regional Fishery Management Council. Staff from the Honolulu Laboratory will be collecting data on the bottom fish and pelagic species covered by fishery management plans either in place or awaiting Department of Commerce approval. Staff members have been reviewing the data collection procedures for the auction and incorporating the data collected into the laboratory's data management procedures. In addition, summaries of the 1984 and 1985 data collected by the Council were prepared for use in the annual report for the Council at the end of the year, and for studying the effectiveness of the data collection process. Statistics are given on number of vessel landings, minimum, maximum, and average weight landed per trip, and mean price for the entire year by species.

Monitoring Activities for Hawaii Skipjack Developed

Program Leader Robert A. Skillman and Computer Programmer Joan P. Thomason have developed computer-based monitoring activities for the Hawaii skipjack tuna fishery to aid in data quality control and routine monitoring of the fishery. In monitoring the skipjack fishery, the samplers conduct on-site interviews of the captains. They collect such information as baiting, landings, and size composition. This information is then summarized for 2-month periods (Table 1). In addition, Skillman developed a frequency plot of fork lengths (mm) of skipjack tuna landed in the period January-April 1986 (Figure 1). (R. Skillman (808) 943-1221)

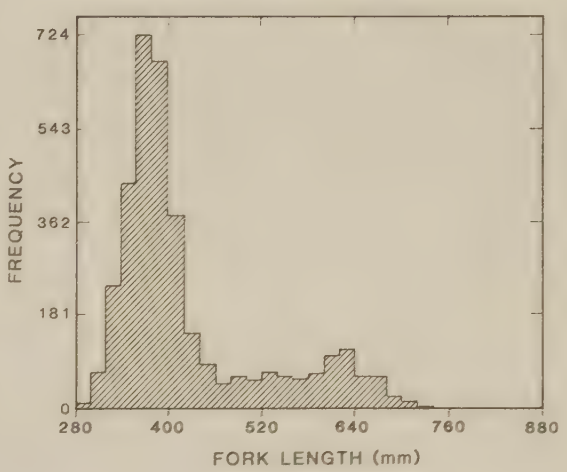

Figure 1. Hawaii skipjack tuna size composition January-April 1986 frequency histogram.

Table 1. Skipjack tuna pole-and-line vessel intercept report for November and December.

Ending date	Vessel interviews	Baiting reports	Landings reports	Size composition reports
11/07/86	4	15	9	3
11/14/86	3	8	5	4
11/21/86	4	6	6	2
11/28/86	No sampling			
12/05/86	No sampling			
12/12/86	No sampling			
12/19/86	No sampling			
12/26/86	No sampling			
Total November and December	11	29	0	9
Total 1986	219	400	427	287

General comments: On November 17-21, bad weather kept most of fleet in port. Baiting in Kaneohe Bay was pretty good with Pearl Harbor described as fair. Most fishing occurred in areas 425-426 with medium small to extra small aku. (R. Skillman (808) 943-1221)

Western Pacific Fishery Council Activities Reported

Program Leader Robert Skillman and Samuel G. Pooley, Industry Economist, attended a meeting of the Western Pacific Regional Fishery Management Council Bottom fish Plan Monitoring Team, which met on October 27, 1986, to discuss progress on the Access Control Plan for the Northwestern Hawaiian Islands bottom fish fishery. The team approved the plan, although there were a number of concerns about the feasibility of specific provisions. Pooley summarized the detailed comments of the team for presentation at the November Council meeting.

During the November Council meeting in Guam and the Commonwealth of the Northern Mariana Islands, the Council broadened considerably the criteria for "initial" entry of vessels under the Access Control Plan for the bottom fish fishery. In addition, the eastern boundary of the qualifying Mau Zone was moved eastward to include fishing grounds normally considered to be part of the main Hawaiian Islands, which is specified in the fishery management plan. For the draft pelagic fishery management plan, the Council developed a triggering mechanism for area closures in response to the U.S. State Department disapproval of automatic proposed area closures in the plan. (R. Skillman (808) 943-1221)

Data Collecting and Processing Systems Expanded in the Pacific

David C. Hamm, Western Pacific Fishery Information Network (WPACFIN) Program Manager, met with Robert Carpenter, Chief Fisheries Officer of the Marshall Islands Marine Resources, Department of Resources and Development, to discuss development of data collecting and processing systems in the Marshall Islands. Carpenter intends to submit a proposal requesting PL 88-309 (a federal/state matching fund program for research and development) funds to begin developing fisheries data collection systems in the Marshall Islands, and wants to ensure that these systems are developed with the cooperation and technical guidance of WPACFIN to ensure compatibility with other Pacific islands systems. Hamm has provided advice and some onsite training to other non-WPACFIN Pacific islands fisheries offices over the past 3 years; for example, the Marshall Islands which are now beginning to develop similar systems compatible with others being developed in Micronesia. In return for this technical assistance, fisheries offices will make their data available to NMFS. Development efforts are already underway and systems are partially functional in the non-WPACFIN participating islands of Palau, Yap, Pohnpei, Kosrae, and Truk. These will add to the information base from the established systems in the islands of American Samoa, the CNMI, Guam, and Hawaii, which officially participate in WPACFIN.

In early December, Hamm canceled a trip to the island of Saipan, the capitol of the CNMI, because a typhoon devastated the island only days before he was to arrive. More than a third of the power poles on the island were turned into firewood by the high winds, and power is not expected to be fully restored for over 2 months. Although the fisheries office is located only 50 feet from the ocean and winds reached 180 mph, the building sustained little damage and the computers and data files contained within were untouched. Hamm will reschedule the trip once the island's power, water, food, and hotel services return to normal. (D. Hamm (808) 943-1221)

MARINE MAMMALS AND ENDANGERED SPECIES PROGRAM

Injured Hawaiian Monk Seal Saved with Volunteer Assistance in First Known Surgery on This Species

William G. Gilmartin, Leader, Marine Mammals and Endangered Species Program, reports that on November 17 the program received a call from people on the Island of Hawaii who saw a Hawaiian monk seal, Monachus schauinslandi, with a severely injured lower jaw and deep cuts on the body. On the morning of November 18, Gilmartin and Biological Technician Robert G. Forsyth traveled to North Kona where the seal was examined to determine whether it should be captured for medical treatment. The seal was a 155 kg

adult male, which appeared to have been struck along its abdomen, chest, and jaw by a boat propeller. The cut through the tip of the mandible had resulted in the loss of 2-3 cm of the bone, including the four lower incisor and two lower canine teeth. All of the animal's injuries were infected.

The seal was collected by NMFS staff and volunteers and transported by air to Oahu where it was taken to Sea Life Park. Voluntary veterinary medical assistance was provided by Dr. Robert Morris, and Dr. Ray Berringer, an oral surgeon, provided specific recommendations on repair of the seal's mouth. The medical team concluded that unless the soft lip tissue which had been torn from the lower jaw was reattached, bone infection was likely to result, with a poor prognosis for the long-term health of the seal.

On November 22, surgery to make the necessary repairs was performed by Berringer, assisted by Morris with Gilmartin managing the general anesthesia. The surgical repair was successful, and antibiotic therapy has controlled the infection. This was the first time anesthesia and surgery are known to have been performed on a Hawaiian monk seal. The kinds of drugs used and the appropriate dosages were determined from experiences with other marine mammals. The information gained from this case will be of great benefit to the program since handling of adult male seals will become a significant part of the program's work during the next few years.

Although "Jaws," as he has been named, appears to be recovering well, he will not be released to the wild because his shortened lower jaw would severely affect his ability to catch live fish and fend off predators. (W. Gilmartin (808) 943-1221)

Hawaii Coastal Cetacean Plan Completed

A research plan for a Hawaii coastal cetacean program has been completed by John R. Henderson, Fishery Biologist. Several species of small cetaceans occur in Hawaiian waters, yet little is known of the general biology or life history for most of these species. The plan identifies research activities designed to determine distribution, abundance, movements, and stock discreteness of the bottlenose dolphin, Tursiops truncatus, the rough-toothed dolphin, Steno bredanensis, and the false killer whale, Pseudorca crassidens, in Hawaiian waters. These species are known to steal bait or catch from several fisheries in Hawaii, and the plan also identifies research activities to develop methods for reducing fishery-cetacean conflicts. (J. Henderson (808) 943-1221)

Green Sea Turtle Nesting on Kauai

George H. Balazs, Zoologist, examined the site of four turtle nest-excavations on December 10. The nest-excavations had

occurred on an isolated beach on the south shore of Kauai in August 1986. Approximately 190 egg shells and unhatched eggs of the green sea turtle, Chelonia mydas, were found at two of the excavations, while the other two excavations were determined to be false nests. The percentage of successful hatching emergence was estimated to be 90%. The Hawaiian population of green sea turtles nests almost exclusively in the remote Northwestern Hawaiian Islands. In the past 3 years, a few nestings have occurred in the main islands, at one site on Molokai, one site on Oahu, and two sites on Kauai. Before these nestings, no cases of nesting on the main islands were known for at least 40 years. (G. Balazs (808) 943-1221)

PELAGIC RESOURCES INVESTIGATION

Manuscript on the Standard Metabolic Rate of Tuna Accepted by Fishery Bulletin

A manuscript entitled "The standard metabolic rate of tunas: Effects of body size and acute temperature change" by Dr. Richard Brill, Fishery Biologist, has been accepted for publication by Fishery Bulletin. In the manuscript, Brill shows that tunas have extremely high standard metabolic rates (the metabolic rate of a post-absorptive animal completely at rest) even when comparisons are made to equally active teleosts at the same water temperature. The hypothesis presented is that tunas' high standard metabolic rates are a direct result of their ability to achieve exceptionally high maximum aerobic metabolic rates. It is the anatomical/physiological/biochemical adaptations that allow tunas to achieve high maximum aerobic metabolic rates that force them to have exceptionally high standard metabolic rates.

The fishery implications of this hypothesis is that models of tuna energetics, natural mortality, or population dynamics should not include explicit or implicit assumptions that tunas are evolved for maximally efficient use of energy resources. Rather, tunas appear to be adapted for maximum rates of energy throughout. Tunas are therefore capable of very high rates of growth and reproduction, but probably they also suffer very high rates of natural mortality. (R. Brill (808) 943-1221)

Proceedings of the 37th Annual Tuna Conference Published

Proceedings of the 37th Annual Tuna Conference, held May 18-21, 1986, at Lake Arrowhead, California, have been published as SWFC Administrative Report H-86-19. Copies of the report may be obtained from the conference chairman, Dr. Richard Brill (NMFS, 2570 Dole St., Honolulu, Hawaii 96822-2396. (R. Brill (808) 943-1221)

Heart Rate Telemetry Experiments of Tuna Begun

Fishery Biologist Peter Bushnell and Brill have begun experiments using FM radio transmitters to monitor changes in heart rate in swimming skipjack, Katsuwonus pelamis, and yellowfin, Thunnus albacares, tunas in response to lowered ambient oxygen conditions. Using these techniques, continuous records of up to several hours duration have been obtained. The reductions in heart rates observed so far, in reaction to lowered ambient oxygen, match exactly those responses previously observed in paralyzed non-swimming (tabled) tunas. These new data, therefore, confirm that the extremely high sensitivity to lowered ambient oxygen previously observed in tabled skipjack and yellowfin tunas was not an artifact of the experimental situation.

Eventually, ultrasonic telemetry techniques will be employed to monitor the heart rates of free swimming fish in the open ocean. The data gathered on swimming tunas in the laboratory are necessary to interpret the heart rates seen in free swimming animals. This work is part of a larger study designed to measure the physiological reactions and tolerances of tunas to low ambient conditions and, therefore, to define more clearly tuna habitat, movements, and gear vulnerability. (R. Brill (808) 943-1221)

DATA MANAGEMENT AND TECHNICAL SERVICES

New PC Installations in Honolulu

For the first time an IBM PC AT was installed on board the NOAA Ship Townsend Cromwell and used for real time data capture. The computer was placed on board the Cromwell during a one-week cruise to test some newly developed software and hardware under normal sea conditions. Results were satisfactory during the cruise (TC 86-06). The PC AT used two floppy drives rather than a hard disk. Two serial communications ports (AST Advantage! boards) were installed to run digital calipers for measuring shrimp carapaces. The calipers, located in the Wet Lab, were hard-wired to an analog-to-digital converter which was in turn connected to the PC AT located in the Electronics Room. Although software problems were encountered in getting the calipers to "talk to" the computer, these difficulties were eventually resolved and software enhancements as well as hardware modifications are already being developed for future cruises.

At the Honolulu Laboratory, an additional four IBM PC AT's were received, tested, and configured for use in several departments. This brings to 15 the number of PC AT's now available at the Laboratory. Major uses for the PC AT's are statistical analysis (primarily SAS and BMDP), graphics

(Chartmaster and Lotus 1-2-3), and spreadsheet functions. The net result is a decreasing reliance on the more expensive University of Hawaii computer facilities. (D. Hamm (808) 943-1221)

PACIFIC FISHERIES ENVIRONMENTAL GROUP
Monterey, California

Ocean Drift Diagrams Produced for Seamount Resources Studies

Chief of PFEG Andy Bakun has developed methods to utilize historical "ship drift" observations to define the likely drift trajectories of planktonic fish larvae spawned in the vicinity of seamount ecosystems in the central North Pacific Ocean. This information will be used by staff of the Seamount Resources Program at the Honolulu Laboratory in their studies of the population dynamics of fishery stocks inhabiting the seamount ecosystems in the central North Pacific Ocean.

Ship drift observations have been collected from ships' logbooks since the 19th Century. Files of these data have been acquired by PFEG from the U.S. Naval Oceanographic Office. The ship drift observations comprise differences between the expected position of the ship based on the apparent speed and heading, and the actual position fixed by celestial navigation. These differences are considered to reflect the influence of ocean currents on the ship's course. Although there is a large component of error inherent in any individual observation of this type, Bakun hopes that by making a composite of large numbers of observations, a realistic pattern of large-scale ocean flow will emerge. Nonetheless, ship drift observations are the only direct indications of ocean surface current pattern presently available for large areas of the ocean.

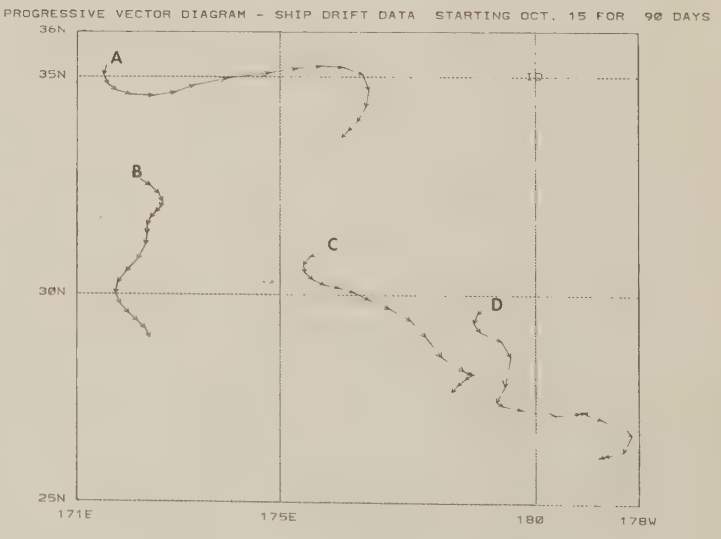

Figure 1. Progressive vector diagrams of surface drift originating at four seamount locations in the central North Pacific Ocean: A. Kinmei Seamount; B. Yuryaku Seamount; C. Colohan Seamount; D. Hancock Seamount. Each individual arrow symbol constitutes 5 days drift. The total time period in this example is 90 days, beginning in mid-October.

Operations Research Analyst Roy Mendelssohn has supervised the design of computer procedures to summarize the historical data files to produce progressive vector diagrams of surface drift (Figure 1), which provide an indication of the sorts of drift trajectories that drifting organisms such as fish larvae, originating in localized seamount ecosystems, may be likely to undergo. (A. Bakun (408) 646-3311)

FISHERY/ENVIRONMENTAL LINKAGES

Spawning Habitats of Argentine and Northern Anchovies Compared

One of the major activities of the Pacific Fisheries Environmental Group (PFEG) is the analysis of the reproductive habitats of small pelagic fishes. This work has been centered on a comparative analysis of the oceanographic and meteorological conditions associated with the spawning grounds of anchovies (Engraulis) and sardines (Sardina and Sardinops), which are very closely related taxonomically. The spawning grounds are found in the world's four principal eastern boundary currents--the California, Peru, Canary, and Benguela Currents. Species of Engraulis also occur in all of the world's western boundary currents and Sardinops occurs in western boundary currents of the Pacific and Indian Oceans. Research at PFEG has shown that the spawning grounds of eastern boundary current anchovies and sardines have common environmental features; however, the currents on the western boundaries of the oceans constitute extremely different ecological systems from those on the eastern boundaries. To determine if knowledge of one type of system can be transferred to the other, Richard Parrish has expanded the comparative analysis to include the western boundary current off Brazil and Argentina.

Results from analysis of the eastern boundary current habitats suggested that three principal environmental features limit the spawning grounds of sardines and anchovies. These features are the temperature of the upper mixed layer, the surface transport pattern, and the relationship between turbulent mixing and stability of the upper water column. The temperature must be within the physiological range required by the early life history stages of the species (about 12-20 Celsius for Engraulis), prevailing geostrophic and wind driven surface currents must result in larval transport trajectories which will bring the juveniles to shallow-water nursery grounds, and there must be enough stability (density gradient) in the upper 40 to 60 meters of the water column to inhibit wind driven turbulent mixing which disperses stratified concentrations of food required by first feeding larvae.

In eastern boundary current regions, spawning grounds of anchovies and sardines are located, both geographically and seasonally, where all three of these environmental conditions are met.

The reproductive habitat of the Argentine anchovy (Engraulis anchoita) covers a large area. Spawning occurs all year off southern Brazil (25°S) and it extends south into Argentina (to about 47°S) during the austral summer. This is an area equivalent to the region from the Florida Keys to Newfoundland.

In evaluating how the three environmental features of the eastern boundary current habitat correspond to the western boundary current habitat, Parrish found the area and seasonality of spawning correspond to the entire neritic area where the sea surface temperature is within the temperature range of the early life history stages of Engraulis.

The prevailing northeastward geostrophic (density driven) transport and northwards Ekman (wind driven) transport result in favorable, onshore larval transport for the entire spawning area and the extremely broad continental shelf also inhibits loss of larvae from the system.

Turbulent mixing energy (the cube of the wind speed) over the central Argentine shelf is significantly higher than that occurring in anchovy spawning grounds in eastern boundary currents. However, in spite of this, the stability of the water column over the Argentine shelf has a seasonal pattern (Figure 2) which is the same as that for anchovy spawning.

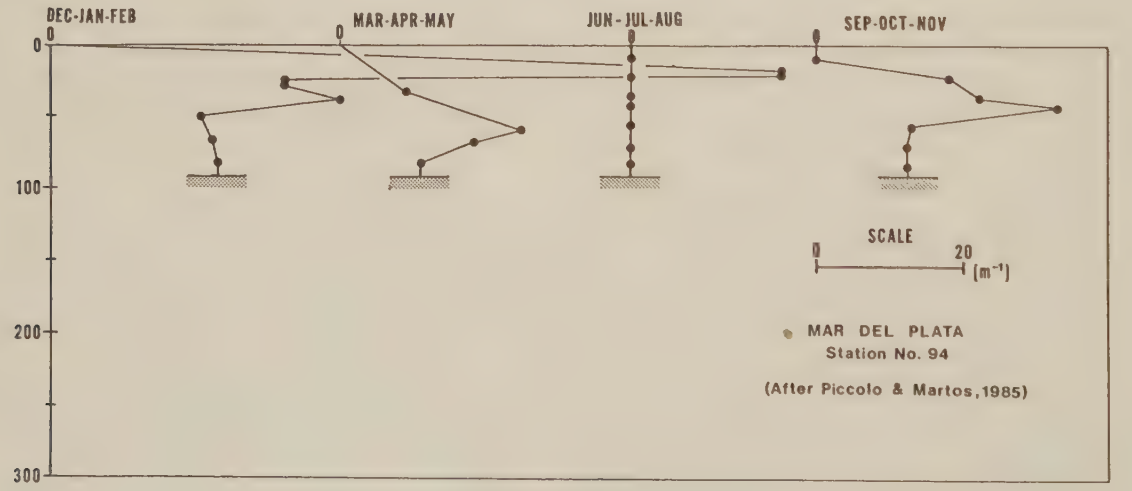

Figure 2. Seasonal variation in the stabililty of the water column, midshelf area, off Mar de Plata, Argentina (depth in meters).

This seasonal, extremely strong stability is caused by a feature that does not occur in the eastern boundary currents--the convergence of a warm poleward current with a cold equatorward current. This results in a seasonal extension of warm water overlying a cold, nutrient-rich layer which causes a very large density gradient, which restricts turbulent mixing to the upper 20 to 30 meters during the spring and summer. (R. Parrish (480) 646-3311)

PELAGIC FISHERY RESOURCES DIVISION
La Jolla, California

Results of Indian Ocean Tuna Meetings Reported

Gary Sakagawa, Chief of the Pelagic Fisheries Resources Division, traveled to Colombo, Sri Lanka, in December 1986 to attend meetings on tuna resources in the Indian Ocean. The first meeting was organized by the Indo-Pacific Tuna Development and Management Program (IPTP), at which he delivered two scientific papers.

Thirty-five scientists participated in the IPTP expert consultation meeting. The participants reviewed information on the state of Indian Ocean tuna stocks and fisheries development. The fastest developing fisheries are for tropical tunas, yellowfin and skipjack tuna, which are caught by vessels of coastal and distant-water nations. The 1985 catch was approximately 243,000 metric tons (mt), an increase of 26% over 1984. Although the coastal nations are concerned over this rapid development (primarily over increased rivalry between coastal artisanal fishermen and the high-seas purse seine fleets) the stocks appear to be healthy and capable of sustaining further increases in exploitation.

Catches of other principal tuna species (bigeye, albacore and southern bluefin) amounted to about 84,000 mt in 1985; the fisheries for these species are primarily with longline gear, employed by vessels of Japan, Korea and Taiwan. The southern bluefin tuna stock is overexploited, whereas the bigeye and albacore stocks appear to be fully exploited without much scope for increased catches with the longline gear.

The secondary tuna and tuna-like species, or "small tunas," are important sources of protein and employment for the coastal nations of the Indian Ocean. In 1985 about 212,000 mt of small tunas were caught primarily by artisanal fishermen. Longtail tuna and seerfishes are the primary species that are exploited and they are high on the list for further fishery development by the coastal nations. No information is available on the state of these stocks.

The second meeting was organized by the Indian Ocean Fishery Commission (IOFC) and involved members of the Committee for the Management of Indian Ocean Tuna. Representatives from France, Japan, Korea, Maldives, Mauritius, Mozambique, Seychelles, Spain, Sri Lanka, Tanzania, Thailand and the United States participated in the IOFC committee meeting, which was chaired by Aloy Fernando of Sri Lanka. Actions adopted by the committee were: (1) recommended continued collection of fishery statistics and conduct of research on stock structure, biology and stock assessment; (2) recommended funding of $1.25M be secured for a Tuna Fisheries Interaction Programme; (3) made minor wording

changes to project document for cost-sharing (55% United Nations Development Program (UNDP), 45% countries) of 1987-89 budget of $1.05M total for IPTP; (4) established committee (France, Japan, Sri Lanka, Thailand and Seychelles and EEC as observer) to develop options for the future of IPTP activities after 1989 when UNDP funding terminates; and (5) elected Sri Lanka to chair committee and Mauritius and Spain to provide vice-chairmen. Next session of the committee will probably be held in Mauritius, pending formal invitation from that government.

STOCK ASSESSMENT AND IMPACT ANALYSIS PROGRAM

1986 Gardiner Foundation Award Winner Named

The Gardiner Foundation of Oakland, California, sponsors an award program for sportfish boat captains in the Baja California Sur, Mexico area that tag the most billfish in a year. Records of tagging are taken from the billfish tagging program, which is sponsored by the Southwest Fisheries Center and directed by Fishery Biologist James Squire. Winners are determined and the National Marine Fisheries Service presents the awards on behalf of the Gardiner Foundation. Awards consist of plaque and cash awards. The 1986 winners, first through sixth place are: Captains Eduardo Cosio, Martin Fiol, Manuel Castro, Victor Garcilia, Vincente Cosio and Filomens Lucars. The award ceremony was held at Rancho Buena, which is located on the east cape area of the tip of Baja California.

Some of the winning captains and Jim Squire, (top left) who made the awards for the Gardiner Foundation, and Mack Walters (second from the right on top row), owner and manager of Rancho Buena Vista.

SWFC Scientists Explain Striped Marlin Tagging at Day at the Docks

The seventh annual Day at the Docks was held on December 14, 1986, along San Diego's waterfront, and for the third year the Southwest Fisheries Center took part in the festivities. The Day at the Docks, which is sponsored by the San Diego Sportfishing Council and the Port District, is held to increase public awareness of sport fishing in San Diego. About 35,000 people came for the boat rides, fish contests, and lobster races.

The Center's exhibit was on striped marlin tagging. Fishery Biologists David Holts and Earl Weber answered questions about the display which featured tagging equipment and information about the Center's tag and release program. Also in the display were sonic tagging and tracking gear used to track striped marlin and swordfish. Holts and Weber, who have conducted sonic billfish tracking, showed charts and graphs of the billfish tracks and the vertical movements of the fish during the track. Mark Helvey, Recreational Fisheries Coordinator for the Southwest Region at Terminal Island, also helped man the exhibit.

From left ro right: Mark Helvey, David Holts, and Earl Weber.

TIBURON LABORATORY
Tiburon, California

GROUNDFISH ANALYSIS INVESTIGATION

Port Sampling Program for the Washington-Oregon-California Sablefish Fishery Reviewed

Joseph Hightower, Fishery Biologist with the Groundfish Analysis Investigation, has completed a preliminary review of the coastwide sampling program for sablefish. Port samples and landings data from January to June 1986 were used to estimate total numbers landed by gear, market category, sex, and length class. The programs used to estimate numbers landed and associated variances were developed using the SAS programming language. The results were used to determine whether sampling effort should be increased or whether sampling effort should be reallocated among strata in 1987.

Estimates of numbers landed were by length class only because age determination is still underway for the fish collected from April to June. Personnel from the Northwest and Alaska Fisheries Center plan to age a total of 2,000 fish for the entire year; this represents a random subsample of about 40% of the 5,000+ fish from which otoliths were collected.

Results from the pilot program were encouraging because the estimates were acceptably precise, so sampling will continue in 1987. Estimates of numbers landed for all gears combined and for trawl-caught fish were relatively precise and should be useful for routine stock assessment. Estimates for fish caught by pots and by longline gear were less precise because landings were smaller and fewer samples were taken for those categories. The current level of sampling effort appears to be adequate; however, overall precision can be increased by reallocating effort among strata. An optimal allocation plan was developed using preliminary estimates of stratum size, variance, and sampling cost. (J. Hightower, FTS 556-0565)

UNDERUTILIZED FISHERY RESOURCES

Alternative Fisheries Projects Resumed

Inshore gillnet fisheries for California halibut and white croaker have for some time been controversial because of the incidental catch of marine mammals and birds. Research by staff of the California Department of Fish and Game and the U.S. Fish and Wildlife Service on the impact of this gear on marine mammals and birds has led to depth limitations on the use of gillnets.

Unfortunately, most halibut and white croaker apparently are distributed in shallow waters, where it is now illegal to use the gillnets. These restrictions have particularly affected immigrant Vietnamese fishermen in the San Francisco Bay Area, most of whom have small boats suitable only for nearshore fishing, and which cannot be easily converted to alternative fishing techniques, whether for catching white croaker or for other species.

One fishing technique which is widely used in many parts of the world, including Vietnam, and which may have applicability in the Bay Area's small-vessel white croaker fishery is pair-trawling. The cost and operation of this gear are compatible with the local situation. However, it remains to be seen whether white croaker can be effectively caught with this gear, and equally important, whether the expected by-catch of other fishes and invertebrates can be kept to acceptable levels. Marine mammals and birds are not vulnerable to this type of gear.

The Vietnamese Fishermen's Association of America (VFAA) started tests of pair trawling with help from staff of the Underutilized Fishery Resources Program in July 1986. After 3 days of fishing with low catches, the volunteer fishermen had to discontinue the project. A permit granted by the California Fish and Game Commission for the use of the pair trawl restricted its use to outside of State waters (3 miles) where white croaker are not particularly abundant. Since that time the project had been on hold, but recently the VFAA was able to obtain funds from conservation agencies in the Bay Area to continue fishing trials with the pair trawl. Kelly Silberberg, Biological Aid, served as observer on December 3 and 4 aboard the vessel Sunrise I, which, along with F/V Molly Brown, conducted the field tests. These vessels replaced the two which did the initial work. Fishery Biologist Sus Kato, leader of the project, worked aboard Sunrise I on December 6, 7, 18 and 19.

Twenty tows with the pair trawl showed that the gear could be effective for catching white croaker. Although the highest catch of white croaker was only 250 pounds in a one-hour tow, both fishermen and biologists involved in the project felt that this was due to the low availability of white croaker in the test area. No salmon, striped bass, birds, or mammals were caught. The catch of dungeness crab, flatfish, and other bottom dwelling animals was not inordinately high. Average catch of dungeness crabs was less than 10 per hour when the net was rigged to fish close to the bottom, and was around 7 per tow hour with improved footrope arrangements. Small English sole was the most significant by-catch, though the total flatfish catch was only around 15 pounds per hour's tow. About half that amount of sharks and rays made up the bulk of the remainder of the catch.

By removing weights on the footrope, or on the sweep lines, catches of bottom dwelling animals (crabs, starfish, moon snails, flatfish) were decreased significantly. The net could also be made to fish slightly off the bottom by using high towing speeds.

For pair trawling to be effective for catching white croaker, the gear must be used in shallow waters where the fish are abundant. The experimental fishing supported by VFAA showed that catches of other species can be kept low. Trials need to be made in white croaker fishing grounds during different seasons to learn the real impact and effectiveness of this gear. Another aspect which needs study is the effectiveness of "Canadian pair-trawling," a procedure which operates more like an encircling net rather than a towed bottom trawl using essentially the same gear.

Another project designed to investigate the effectiveness of alternative fishing gear has been initiated by the California Fisheries Foundation to aid displaced gillnet fishermen who fish for California halibut. This study is funded by a Saltonstal-Kennedy grant. Kato participated in early planning work on the project as a member of an ad hoc committee formed to advise the Foundation. Others serving on the committee include members of CDF&G, Southwest Region, Sea Grant, and Pacific Coast Federation of Fishermen's Cooperatives. Tiburon Laboratory has also provided experimental drift fishing gear to a cooperating fisherman for trial use with halibut. The fisherman reports limited success using the gear, but would like to modify the gear and expand his efforts next season. (S. Kato, FTS 556-0565)

FISHERIES INFORMATION SYSTEMS & ADP

Progress on the 1990s Information Technology Plan (IT-95) Reported

On December 8, 1986, the Office of Management and Budget (OMB) recommended that $3 million for the first phase of the Information Technology upgrade be included in the Congressional submission of NMFS budget. This means that the National Marine Fisheries Service has approval to proceed with the request to procure the next generation computer system which would best meet the agency's needs in the 1990s. Based on the field survey conducted by NMFS headquarters, the preferred and recommended system is a regionally distributed information technology system based on minicomputers.

The first step in the procurement procedure is the preparation of the requirements analysis for the NOAA Information Technology 1995 (IT-95) Requirements Initiative, mandated by federal regulations. The quantitative analysis for this Requirements Initiative will be based on the data provided by the field staff. The data will be collected on two types of questionnaires: the NMFS Host Computer Questionnaire and the NMFS Information/Application Questionnaire. The Host Computer Questionnaire requests information on the usage of mainframes, such as the VAX, IBM, Burroughs, and any other computer that serves multiple remote users in a regional area or building, such as the Molecular 32X. For each discrete application system, the Application Questionnaire gathers information such as mission areas served, operating mode, programming language, software used, current and anticipated sources and destination of data, and volume.

These forms were distributed in mid-December to the field office for completion by the users. NMFS Headquarters has asked for the return of the completed forms as soon as possible in order that the Requirements Analysis can be finished for review by mid-February. (D. Roll, FTS 893-7057)

STATUS OF PUBLICATIONS

Published

Alcorn, D. J., and A. K. H. Kam. 1986. Fatal shark attack on a Hawaiian monk seal (Monachus schauinslandi). Mar. Mammal Sci. 2:313-315.

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Studies on the live-bearing scorpaenid genus Sebastes have recently shown that embryos of one species receive nutrition in addition to that supplied in the yolk. In this large genus, however, reproductive characteristics may differ among species. Energetics of embryonic development in kurosoi, Sebastes schlegeli Hilgendorf, were analyzed to determine the patterns of embryonic nutrition. The egg of this species is larger and contains over three times the energy content of that in S. melanops, another species which has been studied. Catabolism during the 51 days of embryonic development required 88% of the original energy in the egg, but the embryo at birth contained 93% of the initial egg energy. Thus the total energy required for development from fertilization to birth requires 1.8 times the initial, endogenous energy supply. Histological studies demonstrate that uptake occurs through ingestion and absorption of ovarian fluid in the hindgut. Protein and nitrogen budgets during development suggest that the primary substance taken up is nitrogenous.

No distinct structures are apparent in the ovarian system to supply nutrients to the developing embryos. Analysis of fecundity-at-length, however, shows that post-fertilization fecundity estimates are significantly lower than pre-fertilization values; the reduction apparently occurs through resorption of ova or early embryos. Along with catabolism, this results in an overall decrease in the energy content of the ovaries during development, but the total amounts of protein and nitrogen remain nearly static. We thus suggest that resorption of unfertilized ova or early embryos which die may enrich the ovarian fluid and supply energy to the surviving embryos. This is a primitive form of embryonic nutrition in viviparous species and may be common in the genus Sebastes.

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A set of "backward" virtual population analysis (VPA) equations relates catch (C_t) from continuous fishing between times t and t + 1 to population size (N_t, N_{t+1}) when a portion of the stock is unavailable to fishing. The usual VPA equations become a special case where the entire stock is available (i.e. the stock is homogeneous). A close approximation to the VPA equations is $N_t = N_{t+1} \exp(M) + C_t M/(1 - \exp(-M))$, which has properties similar to Pope's "cohort analysis" and is somewhat more accurate in the case of a continuous fishery, especially if the natural mortality rate (M) is large. Much closer simple approximations are possible if the seasonal pattern of catches is known.

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Single nerve fiber discharge was recorded from O_2 sensitive receptors in the first gill arch of the yellowfin tuna, Thunnus albacares, in vitro. These receptors were innervated by the vagus nerve and increased their discharge in response to decreasing perfusion rate, decreasing perfusion P_{O2} and, in most fibers, to decreasing external P_{O2}. Fibers responding to environmental hypoxia exhibited an exponential increase in discharge to decreasing external P_{O2}, with a sensitivity similar to that exhibited by cat carotid body chemoreceptors. Indirect evidence suggests that these receptors are located near the gill vasculature and are more sensitive to changes in arterial P_{O2} than water P_{O2}. Their response characteristics and hypoxic sensitivity strongly implicate them as the afferent limb in the cardiac responses and perhaps also the ventilatory responses exhibited by tuna to environmental hypoxia.

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